Electronic Components For The Commercialization Of Military And Space Systems Workshop

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The Electronic Components For The Commercialization Of Military And Space Systems Workshop held its second annual meeting February 2 through 4, 1998, in Huntington Beach, California and attendance seemed to be even higher than last time; there were at least 400 people present. A very diverse group was in attendance, including representatives from: part manufacturing, parts engineering, circuit design, board and box assembly, system and sub-system integration, marketing, and parts management, control and test. Commercial and government military and space interests were well represented. In all, this was an unusual, possibly unique collection of interests and perspectives to be found together in one room.

The presentations covered topics as diverse as: a new failure mechanism in tantalum chip capacitors; microsatellite batteries and ruggedized PCMCIA disk drives. A majority of the presentations contained one or more of the following, recurring themes:

1) Commercial-off-the-shelf (COTS) works satisfactorily for high reliability applications including space but not "straight out of the box".
2) Successful use of COTS requires:
   a) Careful vendor selection.
   b) Detailed knowledge of the part – performance, strengths and weaknesses.
   c) Qualification by testing, data analysis, etc.
   d) Screening specifically aimed at potential weaknesses that could negatively impact the intended application.
   e) Ruggedized packaging, enclosures, mounting means appropriate to the application.
3) Changes to COTS product, which can affect performance in application, will occur. Trying to prevent this by requiring the vendor to provide notification does not work.
4) The commercial vendor has little or no interest in the military/space market and will do nothing to their product to help suitability for these applications. Changes/process variation can produce large variations in susceptibility to radiation effects, temperature/frequency characteristics etc., within the published catalog envelope.
5) Cost reduction is not a reason to pursue COTS for use in high reliability and space applications. The returns are generally small and the risks may be large. Most of the item cost savings are eliminated by the additional costs of the qualification, screening and selection activities necessary to assure part performance.
6) Few reportedly successful hi-rel applications of COTS are really COTS (see discussion of Mars Pathfinder below).

Two outstanding keynote presentations were given: Colonel Cardine of the US Army who talked about COTS and the Abrams tank and James Clawson of the Jet Propulsion Laboratory who discussed "Common Sense" Mission Assurance as applied to the Mars Pathfinder Project.

Colonel Cardine is the Project Manager for the latest generation of Abrams tank, which is equipped with very sophisticated electronics. The electronics are largely COTS, but heavily ruggedized COTS. Colonel Cardine's statement was "Everything does not have to be military, it just has to be able to survive in a military environment". An example of this philosophy in practice is: a commercial 2-Gigabyte disk drive mounted in a nitrogen-filled, metal, hermetic box, equipped with internal and external shock mounts. The disk drive was COTS but the final package certainly was not!

James Clawson is now the Manager of JPL's Reliability Office and was the Mission Assurance Manager for the Mars Pathfinder Project. Mr. Clawson provided facts about the Mars Pathfinder that clearly show a lot of misinformation has been circulating about this project and its use of COTS. Somehow the rumor got started that Mars Pathfinder used "commercial parts" and Mars Pathfinder became a glowing example of COTS in space. In fact, the bulk of the electronics used for the mission were full MIL specification. Approximately 50% of the microcircuits were Class S the rest were Class B and essentially all of the passives were NASA Grade 1 (MIL failure rate level R and S). The Mars mission achieved its impressive cost control and tight schedule by utilizing a common buy of electronic parts with the CASSINI project, not by extensive use of COTS. There were COTS items used, the modems on the Lander and Rover, the cameras and power modules on the Rover, but they were in the minority and these items are not available as MIL spec. Additionally, the COTS items were upscreened for the extreme Martian environment by the use of extensive burn-in and temperature cycles. In the case of the modems, the two used for flight were hand picked out of the population of 50 units that JPL purchased. Even though the project used mostly NASA Grade 1 and 2 electronic parts, the total parts cost was less than 2% of the total project cost! This suggests that for projects such as one-off scientific satellites, COTS should not be pursued simply to save money.

The Workshop seemed to be in the process of a change of emphasis, away from "what is COTS and can we really use it?" to "what is COTS, how has it been used successfully and what can I learn from this?" Another Workshop is planned for around the same time next year.